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**Description****BACKGROUND OF THE INVENTION****1. Field of the Invention**

The invention relates to an aqueous liquid bleaching composition comprising a solid, substantially water-insoluble organic peroxy acid, which composition may be used for the treatment of fabrics and hard surfaces.

**2. The Prior Art**

Suspending agents for solid, substantially water-insoluble organic peroxy acids in aqueous media have been reported in a number of patents.

U.S. Patent 3,996,152 (Edwards et al.) discloses use of non-starch thickening agents such as Carbopol 940<sup>R</sup> to suspend bleaches such as diperazelaic acid at low pH in aqueous media. Starch thickening agents were found useful in similar systems as reported in U.S. Patent 4,017,412 (Bradley). Thickening agents of the aforementioned types form gel-like systems which upon storage at elevated temperatures exhibit instability problems. When used at higher levels, these thickeners are more stable but now cause difficulties with pourability.

U.S. Patent 4,642,198 (Humphreys et al.) reports a further advance in this technology by the use of surfactants as structurants. A wide variety of detergents including anionics, nonionics and mixtures thereof were reported as effective. Among the nonionics listed were alkoxylated condensation products of alcohols, of alkyl phenols, of fatty acids and of fatty acid amides. According to the examples, particularly preferred are the combinations of sodium alkylbenzene sulphonate and C<sub>12</sub>-C<sub>15</sub> primary alcohols condensed with 7 moles ethylene oxide.

European patent specification 201 958 discloses diperoxydodecanedioic acid containing liquid bleach compositions having a pH in the range 3.5 to 4.1 and also comprising linear alkyl benzene sulphonates and ethoxylated fatty alcohols.

EP-A-0 176 124 (DeJong et al.) reports similar low pH aqueous suspensions of peroxy carboxylic acids. This art informs that surfactants other than alkylbenzene sulphonate have a detrimental effect upon chemical stability of the peroxy carboxylic acid-containing suspensions. Experimental data therein shows a number of well-known detergents causing suspension destabilization. These destabilizing detergents include lauryl sulphate, C<sub>15</sub> alkyl ether sulphate, ethoxylated nonyl phenol, ethylene oxide/propylene oxide copolymer and secondary alkane sulphonate.

EP-A-0 240 481 (Boer et al.) seemingly also finds some special significance in the use of alkylbenzene sulphonate and suggests that the structured diperoxy acid bleach suspensions should be substantially free of other surfactants. The patent then discloses a cleaning procedure whereby a first composition of the low pH surfactant structured 1,12-diperoxydodecanedioic acid can be used in a combination with a second high pH cleaning liquid containing further surfactants, enzyme and evidently neutralized C<sub>12</sub>-C<sub>15</sub> fatty acid.

U.S. Patent 4, 655, 781 (Hsieh et al.) reports the structuring of surface-active peroxy acids in substantially non-aqueous media at pH 7 to 12. Surfactants experimentally investigated included linear alkylbenzene sulphonate, fatty acids and sodium alkyl sulphate.

A problem which has been noted with all the foregoing systems is that while chemical and physical stability may have been improved within the lower temperature range, there still remain instability problems at slightly elevated temperatures.

Consequently, it is an object of the present invention to provide an improved aqueous liquid bleach composition comprising a solid, substantially water-insoluble organic peroxy acid wherein the above drawbacks are mitigated.

More specifically, it is an object of the present invention to provide an aqueous suspension of a solid, substantially water-insoluble organic peroxy acid which is chemically and physically storage stable throughout a wide range of temperatures.

These and other objects of the present invention will become apparent as further details are provided in the subsequent discussion and Examples.

## SUMMARY OF THE INVENTION

The present invention relates to an aqueous liquid bleaching composition having a pH of from 1 to 6.5, comprising from 1 to 40% by weight of a solid, particulate substantially water-insoluble organic peroxy acid; from 1 to 30% by weight of an anionic surfactant and from 0.5 to 20% by weight of an ethoxylated nonionic surfactant; characterised in that it also comprises a fatty acid present in an amount of from 1 to 5% by weight to stabilize said peroxy acid against phase separation from the aqueous liquid.

## DETAILED DESCRIPTION OF THE INVENTION

It has now been discovered that water-insoluble organic peroxy acids can be stably suspended in low pH water by a combination of anionic surfactant, ethoxylated nonionic surfactant and a fatty acid. Heretofore, it had not been realized that broad temperature stability can be attained by a combination of three surfactants, especially with a system incorporating fatty acid.

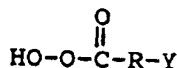
Thus, the compositions of this invention will require a fatty acid, especially a C<sub>12</sub>-C<sub>18</sub> alkyl monocarboxylic acid. Suitable fatty acids include lauric (C<sub>12</sub>), myristic (C<sub>14</sub>), palmitic (C<sub>16</sub>), margaric (C<sub>17</sub>), stearic (C<sub>18</sub>) acids and mixtures thereof. Sources of four such acids may be coconut oil which is rich in the lauric constituents, tallow oil which is rich in the palmitic and stearic constituents and mixtures of coconut/tallow oils. Particularly preferred are coconut/tallow combinations of about 80:20 ratio. Amounts of the fatty acids range from 1 to 5%, optimally from 2 to 3% by weight.

A variety of alkoxyated nonionic surfactants is employed as the second structuring detergent. Illustrative of this category are the ethylene oxide (and optionally propylene oxide) condensation products of C<sub>8</sub>-C<sub>20</sub> linear- or branched-chain aliphatic carboxylic acids, aliphatic alcohols and alkyl phenols. Especially preferred, however, are the C<sub>12</sub>-C<sub>18</sub> aliphatic alcohols ethoxylated with an average of from 3 to 12 moles of ethylene oxide per alcohol molecule. Even more specifically, the C<sub>12</sub>-C<sub>15</sub> alcohols condensed with either an average of 3 or 9 moles ethylene oxide and the C<sub>12</sub>-C<sub>14</sub> aliphatic alcohols condensed with 7 moles ethylene oxide have been found to be highly effective. Amounts of the alkoxyated nonionic will range from 0.5 to 20% by weight, preferably from 1 to 5%, optimally between 1 and 2% by weight.

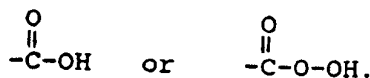
A third required structuring agent is an anionic surfactant. Examples of such material are water-soluble salts of alkylbenzene sulphonates, alkyl sulphates, alkyl ether sulphates, dialkyl sulphosuccinates, paraffin sulphonates,  $\alpha$ -olefin sulphonates,  $\alpha$ -sulphocarboxylates and their esters, alkyl glycerol ether sulphonates, fatty acid monoglyceride sulphates and sulphonates, alkyl phenol polyethoxy ether sulphates, 2-acyloxy-alkane-1-sulphonates,  $\beta$ -alkoxyalkane sulphonates and mixtures thereof. Although all the aforementioned anionic surfactants are operative, it has been observed that secondary alkane sulphonates exhibit an especially effective interaction with fatty acid and alkoxyated nonionic surfactant. Secondary alkane sulphonates are commercially available from Hoechst under the trademark Hostapur SAS 60. Amounts of the anionic material will range from 1 to 30%, preferably from 5 to 30%, optimally between 5 and 10% by weight.

Organic peroxy acids usable for the present invention are those that are solid and substantially water-insoluble compounds. By "substantially water-insoluble" is meant herein a water-solubility of less than about 1% by weight at ambient temperature. In general, peroxy acids containing at least 7 carbon atoms are sufficiently insoluble in water for use herein.

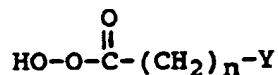
These materials have the general formula:



wherein R is an alkylene or substituted alkylene group containing from 6 to 22 carbon atoms or a phenylene or substituted phenylene group, and Y is hydrogen, halogen, alkyl, aryl or

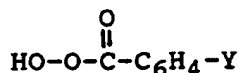


The organic peroxy acids usable in the present invention can contain either one or two peroxy groups and can be either aliphatic or aromatic. When the organic-peroxy acid is aliphatic, the unsubstituted acid has the general formula:



where Y can be, for example, H, CH<sub>3</sub>, CH<sub>2</sub>Cl, COOH or COOCH<sub>3</sub>; and n is an integer from 6 to 20.

When the organic peroxy acid is aromatic, the unsubstituted acid has the general formula:



wherein Y is hydrogen, alkyl, alkylhalogen or halogen, or COOH or COOCH<sub>3</sub>.

Typical monoperoxy acids useful herein include alkyl peroxy acids and aryl peroxy acids such as:

- (i) peroxybenzoic and ring-substituted peroxybenzoic acids, e.g. peroxy- $\alpha$ -naphthoic acid;
- (ii) aliphatic and substituted aliphatic monoperoxy acids, e.g. peroxy lauric acid and peroxy stearic acid.

Typical diperoxy acids useful herein include alkyl diperoxy acids and aryldiperoxy acids, such as:

- (iii) 1,12-diperoxydodecanedioic acid;
- (iv) 1,9-diperoxyazelaic acid;
- (v) diperoxybrassylic acid, diperoxysebacic acid and diperoxyisophthalic acid;
- (vi) 2-decyldiperoxybutane-1,4-dioic acid;
- (vii) 4,4'-sulphonylbis(2-peroxybenzoic acid).

The preferred peroxy acids are 1,12-diperoxydodecanedioic acid (DPDA) and 4,4'-sulphonylbis(2-peroxybenzoic acid).

The particle size of the peroxy acid used in the present invention is not crucial and can be from 1 to 2,000 microns, although a small particle size is favoured for laundering application.

The composition of the invention contains from 1 to 40% by weight of the peroxy acid, preferably from 2 to 30%, optimally between 2 and 10% by weight.

Aqueous liquid products encompassed by the invention will have preferably a viscosity in the range of from 50 to 20,000 centipoises (0.05 to 20 Pascal seconds) measured at a shear rate of 21 second<sup>-1</sup> at 25°C. In most cases, however, products will have a viscosity of from 0.2 to 12 PaS, preferably between 0.5 and 1.5 PaS.

Also of importance is that the aqueous liquid bleaching compositions of this invention have an acidic pH in the range of from 1 to 6.5, preferably from 2 to 5.

Also advantageous is the use of an additional amount of hydrogen peroxide, preferably ranging from 1 to 10% by weight. This peroxide component has been found quite useful in preventing the staining of fabrics by metal oxides which form in the reaction between metals and organic peroxy acids.

Electrolytes may be present in the composition to provide further structuring advantage. The total level of electrolyte may vary from 1 to 30%, preferably from 1.5 to 25% by weight.

Since most commercial surfactants contain metal ion impurities (e.g. iron and copper) that can catalyze peroxy acid decomposition in the liquid bleaching composition of the invention, those surfactants are preferred which contain a minimal amount of these metal ion impurities. The peroxy acid instability results in fact from its limited, though finite, solubility in the suspending liquid phase and it is this part of the dissolved peroxy acid which reacts with the dissolved metal ions. It has been found that certain metal ion complexing agents can remove metal ion contaminants from the composition of the invention and so retard the peroxy acid decomposition and markedly increase the lifetime of the composition.

Examples of useful metal ion complexing agents include dipicolinic acid, with or without a synergistic amount of a water-soluble phosphate salt; dipicolinic acid N-oxide; picolinic acid; ethylene diamine tetraacetic acid (EDTA) and its salts; various organic phosphonic acids or phosphonates such as hydroxyethylidenediphosphonic acid (Dequest 2010®), ethyl diamine tetra-(methylene phosphonic acid), and diethylene triamine penta-(methylene phosphonic acid).

Other metal complexing agents known in the art may also be useful, the effectiveness of which may depend strongly on the pH of the final formulation. Generally, and for most purposes, levels of metal ion complexing agents in the range of from 10-1000 ppm are effective to remove the metal ion contaminants.

In addition to the components discussed above, the liquid bleaching compositions of the invention may also contain certain optional ingredients in minor amounts, depending upon the purpose of use. Typical examples of optional ingredients are suds-controlling agents, fluorescers, perfumes, colouring agents,

abrasives, hydrotropes and antioxidants. Any such optional ingredient may be incorporated provided that its presence in the composition does not significantly reduce the chemical and physical stability of the peroxy acid in the suspending system.

The following Examples will more fully illustrate the embodiments of this invention. All parts, percentages and proportions referred to herein and in the appended claims are by weight of the total composition unless otherwise stated.

#### EXAMPLE 1

10 A series of liquid bleach compositions were prepared by suspending 1,12-diperoxyldecanedioic acid (DPDA) in various surfactant structured liquid compositions. These formulations are outlined in Table I. Preparation of these compositions involved dissolving the appropriate amount of sodium sulphate in 10% of the water used in the formulation. Meanwhile, 35-50% of the total water was heated to 45-50°C. When present in the formulation, fatty acid, e.g. lauric acid, was slowly added to the reactor with stirring until it  
15 had melted. When a longer chain fatty acid was used, a higher water temperature was employed. Temperature was maintained at 45°C and there was then added the anionic and/or nonionic surfactant. Hydroxyethylenediphosphonic acid was added and the pH adjusted to 4. Thereafter, the sodium sulphate solution was added and the mixture stirred for about 5 minutes. DPDA was then charged to the reactor and stirred at 30-40°C for 30 minutes, then cooled with stirring.  
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TABLE I

Ingredients	% by weight							
	A	B	C	D	E	F	G	H
Secondary alkane sulphonate	9.0	8.0	-	8.0	-	-	8.0	8.0
Sodium alkylbenzene sulphonate	-	-	6.65	-	8.0	8.0	-	-
C <sub>12</sub> -C <sub>15</sub> primary alcohol/ 3 moles ethylene oxide	-	-	-	2.0	-	-	2.0	-
C <sub>12</sub> -C <sub>14</sub> primary alcohol/ 7 moles ethylene oxide	-	-	-	-	-	1.0	-	1.5
C <sub>12</sub> -C <sub>15</sub> primary alcohol/ 9 moles ethylene oxide	-	1.0	2.85	-	-	-	-	-
Caprylic acid	-	-	-	-	0.14	0.14	-	-
Capric acid	-	-	-	-	0.12	0.12	-	-
Lauric acid	1.92	1.42	-	-	1.02	1.02	1.42	1.42
Myristic acid	0.08	0.56	-	-	0.36	0.36	0.56	0.56
Palmitic acid	-	0.02	-	-	0.20	0.20	-	-
Stearic acid	-	-	-	-	0.14	0.14	-	-
Anhydrous sodium sulphate	3.0	3.0	6.65	12.0	3.50	3.5	3.0	3.0
DPDA	4.9	5.1	5.21	4.5	4.83	4.7	4.85	5.13
Dequest 2010 <sup>®</sup>	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Water + 10% sulphuric acid to adjust pH to 3.5-4.5	----- balance -----							

TABLE II

Composition	Physical Stability		
	2 °C	22 °C	50 °
A	unstable	stable	stable
B	stable	stable	stable
C	stable	stable	unstable
D	stable	stable	unstable
E	unstable	stable	stable
F	stable	stable	stable
G	stable	stable	stable
H	stable	stable	stable

Table II provides the physical stability data for compositions outlined in Table I. Where the composition was indicated to be unstable, phase separation and settling of DPDA particles occurred within 1-5 days. Compositions were considered stable if less than 10% separation and/or phase separation occurred after one week.

Composition B incorporating sulphonate/fatty acid/nonionic ethoxylate had excellent stability both at 2 °C and 50 °C. Indeed, this composition survived five freeze-thaw cycles over a two week period. By comparison, compositions C and D containing sulphonate/nonionic ethoxylate but having no fatty acid were unstable at 50 °C storage conditions. Compositions A and E containing sulphonate/fatty acid but without nonionic ethoxylate exhibited instability at 2 °C. Finally, compositions F, G and H illustrate other formulations within the present invention that provide stability at low, room and elevated temperatures.

#### EXAMPLE 2

A typical composition of the present invention is outlined hereinbelow.

Component	Weight % Active
1,12-diperoxydodecanedioic acid	4.5
Hostapur 60 SAS®	6.0
Alfonic 1412-60®	2.0
Emery 625®	2.0
Sodium sulphate	2.8
Dequest 2010®	0.04
Optical brightener/perfume	0.22
Deionized water	to 100%

Emery 625® is a coconut oil fatty acid mixture having molecular weight ranging from 201 to 207.

The aforementioned composition was found to be stable both at 35 °F (1.66 °C) under freeze-thaw conditions and at 125 °F (50 °C) simulating elevated storage temperatures.

#### Claims

1. An aqueous liquid bleaching composition having a pH of from 1 to 6.5, comprising from 1 to 40% by weight of a solid, particulate substantially water-insoluble organic peroxy acid; from 1 to 30% by weight of an anionic surfactant and from 0.5 to 20% by weight of an ethoxylated nonionic surfactant; characterised in that it also comprises a fatty acid present in an amount of from 1 to 5% by weight to stabilize said peroxy acid against phase separation from the aqueous liquid.
2. A composition according to claim 1, wherein said peroxy acid is 1,12-diperoxydodecanedioic acid.
3. A composition according to claim 1, wherein said peroxy acid is selected from the group consisting of 1,9-diperoxyazelaic acid and 4,4'-sulphonylbis(peroxybenzoic acid).

4. A composition according to claim 1, 2 or 3, wherein said anionic surfactant is a secondary alkane sulphonate.
5. A composition according to claim 1, 2 or 3, wherein said anionic surfactant is an alkylbenzene sulphonate.
6. A composition according to any of the above claims 1-5, wherein said ethoxylated nonionic surfactant is a C<sub>12</sub>-C<sub>18</sub> fatty alcohol condensed with from 3 to 9 moles ethylene oxide per fatty alcohol molecule.
7. A composition according to claim 1, 2 or 3, wherein said peroxy acid is present in an amount between 2 and 10% by weight.
8. A composition according to claims 1, 4 or 5, wherein said anionic surfactant is present in an amount between 5 and 10% by weight.
9. A composition according to claim 1 or 6, wherein the alkoxyated nonionic surfactant is present in an amount between 1 and 2% by weight.
10. A composition according to any of the above claims 1-9, wherein the fatty acid is a C<sub>12</sub>-C<sub>18</sub> fatty alkyl monocarboxylic acid.
11. A composition according to claim 1, wherein the fatty acid is present in an amount of from 2 to 3% by weight.
12. A composition according to any of the above claims 1-11, having a viscosity from 0.05 to 20 PaS measured at a shear rate of 21 sec<sup>-1</sup> at 25 °C.
13. A composition according to any of the above claims 1-12, further comprising from 1 to 10% by weight of additional hydrogen peroxide.

#### Patentansprüche

1. Eine wässrige flüssige Bleichmittelzusammensetzung mit einem pH-Wert von 1 bis 6,5, enthaltend von 1 bis 40 Gewichtsprozent einer festen, teilchenförmigen, im wesentlichen wasserunlöslichen organischen Peroxysäure, von 1 bis 30 Gewichtsprozent eines anionischen Surfactants und von 0,5 bis 20 Gewichtsprozent eines ethoxylierten nichtionischen Surfactants, **dadurch gekennzeichnet**, daß sie auch eine Fettsäure, vorhanden in einer Menge im Bereich von 1 bis 5 Gewichtsprozent, zur Stabilisierung der Peroxysäure gegen Phasentrennung von der wässrigen Flüssigkeit, enthält.
2. Eine Zusammensetzung nach Anspruch 1, worin die Peroxysäure 1,12-Diperoxydodecandisäure ist.
3. Eine Zusammensetzung nach Anspruch 1, worin die Peroxysäure aus der Gruppe bestehend aus 1,9-Diperoxyazelaensäure und 4,4'-Sulfonylbisperoxybenzoesäure ausgewählt ist.
4. Eine Zusammensetzung nach Anspruch 1, 2 oder 3, worin das anionische Surfactant ein sekundäres Alkansulfonat ist.
5. Eine Zusammensetzung nach Anspruch 1, 2 oder 3, worin das anionische Surfactant ein Alkylbenzolsulfonat ist.
6. Eine Zusammensetzung nach einem der obigen Ansprüche 1 bis 5, worin das ethoxylierte nichtionische Surfactant ein C<sub>12</sub>-<sub>15</sub>-Fettalkohol ist, kondensiert mit von 3 bis 9 Mol Ethylenoxid pro Fettalkohol-Molekül.
7. Eine Zusammensetzung nach Anspruch 1, 2 oder 3, worin die Peroxysäure in einer Menge zwischen 2 und 10 Gewichtsprozent anwesend ist.

8. Eine Zusammensetzung nach Anspruch 1, 4 oder 5, worin das anionische Surfactant in einer Menge zwischen 5 und 10 Gewichtsprozent anwesend ist.
9. Eine Zusammensetzung nach Anspruch 1 oder 6, worin das alkoxylierte nichtionische Surfactant in einer Menge zwischen 1 und 2 Gewichtsprozent anwesend ist.
10. Eine Zusammensetzung nach einem der obigen Ansprüche 1 bis 9, worin die Fettsäure eine C<sub>12-18</sub>-Fettalkylmonocarbonsäure ist.
11. Eine Zusammensetzung nach Anspruch 1, worin die Fettsäure in einer Menge von 2 bis 3 Gewichtsprozent anwesend ist.
12. Eine Zusammensetzung nach einem der obigen Ansprüche 1 bis 11, die eine Viskosität im Bereich von 0,05 bis 20 Pa.s, gemessen bei einer Scherrate von 21 Sekunden<sup>-1</sup> bei 25 ° C, aufweist.
13. Eine Zusammensetzung nach einem der obigen Ansprüche 1 bis 12, die ferner von 1 bis 10 Gewichtsprozent zusätzliches Wasserstoffperoxid enthält.

#### Revendications

1. Une composition de blanchiment aqueuse présentant un pH variant entre 1 et 6,5, comprenant un acide peroxy organique substantiellement insoluble dans l'eau, particulaire et solide à raison de 1 à 40 % en masse, un agent tensioactif anionique à raison de 1 à 30 % en masse et un agent tensioactif non ionique éthoxylé à raison de 0,5 à 20 % en masse, caractérisée en ce qu'elle contient en outre un acide gras présent dans une proportion comprise entre 1 et 5 % en masse pour stabiliser ledit acide peroxy contre la séparation de phase depuis la phase liquide.
2. Une composition selon la Revendication 1, dans laquelle ledit acide peroxy est de l'acide 1,12-diperoxydodécanedioïque.
3. Une composition selon la Revendication 1, dans laquelle ledit acide peroxy est sélectionné parmi le groupe composé d'acide 1,9-diperoxyazélaïque et d'acide 4,4'-sulfonylbisperoxybenzoïque.
4. Une composition selon la Revendication 1, 2 ou 3, dans laquelle ledit agent tensioactif anionique est un sulfonate d'alcane secondaire.
5. Une composition selon la Revendication 1, 2 ou 3, dans laquelle ledit agent tensioactif anionique est un sulfonate d'alkylbenzène.
6. Une composition selon l'une quelconque des Revendications 1 à 5, dans laquelle ledit agent tensioactif non ionique éthoxylé est un alcool gras en C<sub>12-C18</sub> condensé avec 3 à 9 moles d'oxyde d'éthylène par molécule d'alcool gras.
7. Une composition selon la Revendication 1, 2 ou 3, dans laquelle ledit acide peroxy est présent dans une proportion comprise entre 2 et 10 % en masse.
8. Une composition selon la Revendication 1, 4 ou 5, dans laquelle ledit agent tensioactif anionique est présent dans une proportion comprise entre 5 et 10 % en masse.
9. Une composition selon la Revendication 1 ou 6, dans laquelle l'agent tensioactif non ionique alkoxylé est présent dans une proportion comprise entre 1 et 2 % en masse.
10. Une composition selon l'une quelconque des Revendications 1 à 9, dans laquelle l'acide gras est un alkylacide monocarboxylique gras en C<sub>12-C18</sub>.
11. Une composition selon la Revendication 1, dans laquelle l'acide gras est présent dans une proportion comprise entre 2 et 3 % en masse.

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12. Une composition selon l'une quelconque des Revendications 1 à 11, présentant une viscosité comprise entre 0,05 et 20 PaS mesurée à un gradient de cisaillement de 21 secondes à une température de 25 °C.
- 5 13. Une composition selon l'une quelconque des Revendications 1 à 12, comprenant en outre du peroxyde d'hydrogène supplémentaire à raison de 1 à 10 % en masse.

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